SM6625

Satellite Modulator with PREKOR™

The rapid rise of bitrate intensive high definition television and the continuing need for cost-effective transmission over satellite is accelerating the change to more efficient transmission technology. The new DVB-S2 standard is at the forefront of providing the means to fulfilling this requirement.

The TANDBERG Television SM6625 is a feature-rich, compact, L-band output satellite modulator. This future-proof product gives DVB-S, DVB-DSNG and now DVB-S2 modulations. Integrated into the unit is TANDBERG Television's award winning PREKOR™ technology that further enhances system performance making this modulator the class leader in its field.

BASE UNIT FEATURES

SM6625 Satellite Modulator (SM6625/BAS)

- Operation to ETSI standard EN 300 421 (DVB-S: BPSK and QPSK)
- Variable symbol rate operation: 1 to 48 Msymbol/s
- User selectable spectrum roll-off factor: 20%, 25%, 30%, 35%

  Transmission quality L-band output: 950 – 1750 MHz, tunable in 1 kHz steps

  L-band output provides switchable DC power and 10 MHz frequency reference for external up-converter

- L-band monitor output and communications channel L-band input and combiner
- Digitally generated cable tilt correction
- 2 DVB ASI inputs
- Input data rate adaptation mode – including PCR correction
- PREKOR™ Dynamic Pre-correction technology
  - Corrects for phase/magnitude distortions introduced by uplink HPA equipment
  - Corrects for phase/magnitude distortions introduced by the satellite
  - Corrects for group delay distortions introduced by the satellite transponder
- Easy software upgrades for extra features
- Web Browser control and via easy-to-use front panel, SNMP, RS-232 or RS-485 remote control or Telnet

OPTIONS

DVB-DSNG Higher Order Modulation Option (SM66XX/SWO/HOM)

- 8PSK and 16QAM option to EN 301 210 standard in addition to BPSK and QPSK

Extended Symbol Rate Option (SM66XX/SWO/HS)

- Extends the symbol rate from 1 to 48 Msymbol/s to 0.2 to 66 Msymbol/s

PREKOR™ License (SM66XX/SWO/PREKOR)

- PREKOR™ license key and PC control software

Additional Transport Stream Inputs (SM66XX/HWO/ASI-SPI)

- Additional 2 x DVB ASI and 1 x DVB SPI input option

DVB-S2 QPSK Modulation Option (SM66XX/SWO/S2)

- DVB-S2 Broadcast mode QPSK modulation to EN 302 307

DVB-S2 8PSK Modulation Option (SM66XX/SWO/S2-8PSK)

- DVB-S2 Broadcast mode 8PSK modulation to EN 302 307 SM66XX/SWO/S2 also required

DVB-S2 16APSK Modulation Option (SM66XX/SWO/S2-16APSK)

- DVB-S2 Broadcast mode 8PSK, 16APSK and 32APSK modulations to EN 302 307
- SM66XX/SWO/S2 also required

PRODUCT OVERVIEW

All Modulation Modes

The SM6625 supports all DVB standard modulation modes (DVB-S, DVB-DSNG, DVB-S2) making this well specified product extremely flexible and capable of performing in all types of system architectures.

Variable Symbol Rate

The SM6625's wide symbol rate range from 0.2 to 66Msymbol/s makes it suitable for all applications from low bitrate DSNG transmissions to high data rate IP backbone applications.

High Quality L-band Output

The SM6625 follows the high spec design philosophy through to its L-band output stage by offering the highest possible transmission quality. The SM6625 offers a number of signal quality improvement tools such as group delay correction through PREKOR™ and digitally generated cable tilt correction to ensure that the received satellite signal is free from distortions.

Full Set of Control Methods

The SM6625 incorporates an easy to use web browser control interface as well as full control through SNMP, RS232, RS485 and Telnet sessions. For local control the SM6625 also has a simple to operate front panel control.

About DVB-S2

DVB-S2 is the next generation standard for satellite broadcasting offering up to a 30% increase in throughput or a 1.5 to 2dB increase in link margin bringing 8PSK within the reach of consumer sized dishes. The combination of savings in bitrate from Advanced Video Coding and the increased efficiency of DVB-S2 makes the transmission of HD video a real and financially attractive reality.

Example DVB-S2 Configuration for Equivalent Failure Point to DVB-S

| Standard	Modulation	FEC	Symbol Rate	Bit Rate	PREKOR	% Bit Rate Increase
DVB-S	QPSK	2/3	27.5	33.8	Off	N/A
DVB-S2	QPSK	3/4	29.5	43.9	On	**30%**

About PREKOR™

TANDBERG Television's unique PREKOR™ option ensures optimum performance from the satellite link for those who wish to get the most from their system.

Applications such as satellite distribution of TV to multiple headends and Internet backbone applications are particularly suited to the implementation of PREKOR™. In these applications cost per bit is of primary consideration. The improvement in the satellite link margin that PREKOR™ gives can result in an increase in data capacity of up to 7% for QPSK, 22% for a DVB-DSNG 8PSK system and up to 55% for a 16QAM system.

16QAM Without Prekor   16QAM With Prekor
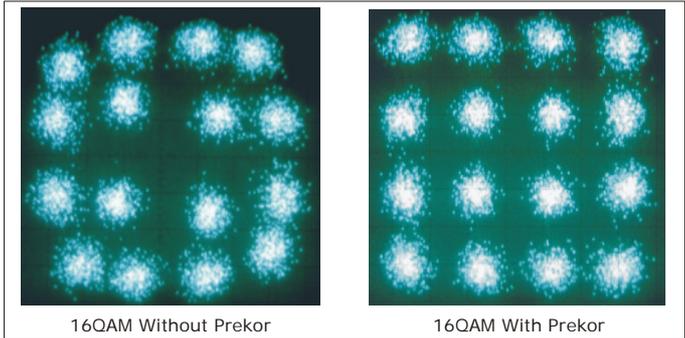
PREKOR™ is of benefit to users employing satellite modulation in a single carrier per transponder mode. In this mode maximum power efficiency of the satellite link is achieved by operating the satellite transponder at saturation. The dynamic pre-correction technology of PREKOR™ corrects for group delay and removes the phase and magnitude non-linear distortions introduced by operating the transponder at saturation. The higher order modulations of 8PSK, 16QAM and 16APSK are particularly sensitive to these distortions and so PREKOR™ can yield large improvements in the satellite link margin.

PRODUCT OVERVIEW
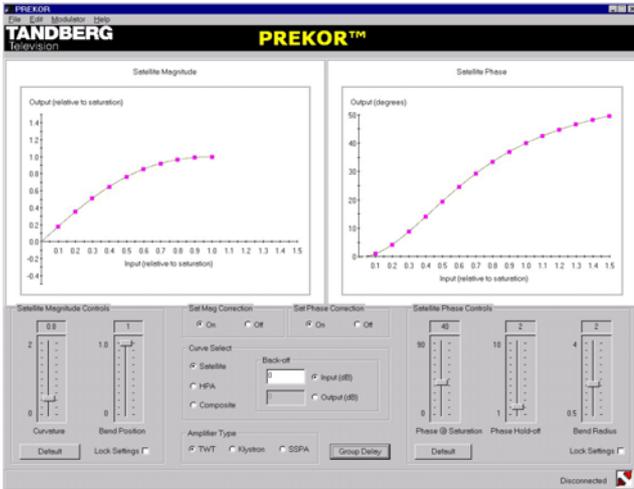
Integrating PREKOR™ into an earth station generally has little effect on the system architecture. PREKOR™ is housed in the SM6625 satellite modulator, which provides industry standard interfaces. When required to operate with transponders having no AGC, a beacon receiver may be required in order to adjust the correction process automatically during rain fades. PREKOR™ is configured on installation for use with a particular path. There is no need to be able to see the downlink during operation, and during installation it is possible to extend control of the modulator to the receive site via the Internet. The ability to store numerous configurations allows its use in complex redundancy systems.

PREKOR™ requires no special equipment at the receive station. Any receiver compliant with EN 300 421, EN 301 210 or EN 302 307 such as the TT1260, may be used.

PREKOR™ SPECIFICATIONS

Satellite channel normalised small signal gain:	4.0 dB maximum
Phase correction range:	0 - 90°
Phase polarity:	Lag or lead with increasing amplitude
Group delay correction range:	0 – 200 ns at the transponder band edge
Group delay correction shape:	Parabolic + n^{th} order term, n = 2-7
Symbol rate range:	1 – 48 Msymbol/s 0.2 – 66 Msymbol/s (option)
Transmit/receive roll-off factor:	25%

Note: Some DVB receivers operate with 0.35 roll-off. Such a mismatch does not introduce significant degradation.

EARTH STATION REQUIREMENTS

In order to ensure that PREKOR™ can deliver the best possible performance, it is important that the overall performance of both uplink and downlink earth stations meet certain minimum requirements. These requirements will depend upon individual circumstances. Please contact TANDBERG Television for further information.

IMPROVEMENTS DUE TO PREKOR™

Pre-correction gain may be specified in two ways:

- As a system threshold improvement in dB for a fixed user bitrate.

- As a percentage increase in the user bit-rate for a fixed system threshold. This assumes that an appropriate code-rate is available.

The total gain in system performance is not achieved from any single feature of the system. A large system gain is normally the result of the combination of the individual improvements to the system. The table below gives a maximum expectation of system gain for a TWT based transponder in conjunction with a TWT based HPA driven at 3 dB OBO and a typical level of uplink noise.

Ni = Non-linear improvement, Gi = Group delay improvement

Modulation	Ni	Gi	Ni + Gi
DSNG 8PSK 5/6	1.0 dB	1.0 dB	2.0 dB
	10%	10%	20%
DSNG 8PSK 8/9	1.2 dB	1.8 dB	3.0 dB
	12%	10%	22%
DSNG 16QAM 3/4	4.0 dB	2.0 dB	6.0 dB
	40%	15%	55%
DSNG 16QAM 7/8	>4.0 dB	>2.0 dB	>6.0 dB
	>40%	>15%	>55%

SAMPLE CONFIGURATION
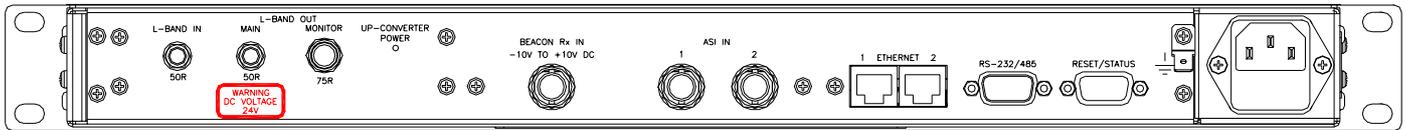
SPECIFICATIONS

Inputs

Transport Stream Inputs

2 x DVB ASI Copper
Rear panel connector: BNC (F) 75 Ohm

+2 x DVB ASI Copper (option)
Rear panel connector: BNC (F) 75 Ohm

+1 x DVB SPI (option)
Rear panel connector: 25-way D-type (F)

Transport Stream Data Specification

ASI
Data Rate: 213 Mbit/s maximum
ASI Format: Byte and single packet burst mode
Packet Size: 188-byte, 204-byte, unframed

SPI
Data Rate: 108 Mbit/s maximum
Packet Size: 188-byte, 204-byte, unframed

Data Clocking Modes
Input data rate adaptation mode including PCR correction
Input data rate derived mode

Analog Inputs
1 x Beacon Rx Input
Rear panel connector: BNC (F)
-10 V to +10 V range for Uplink Fade Control

Output Specification

L-Band Output

Main L-Band Output
Frequency Range: 950 – 1750 MHz)
IF Frequency Step Size: 1 kHz
Frequency Error: ±1 kHz maximum
Output Power: -20 to +5 dBm (0.1 dB steps)
Output Power Stability: ±0.5 dB
Impedance: 50Ω
Connector: SMA (F)

Spurious Outputs
< -60 dBc/4 kHz over 0-500 MHz (modulated carrier)
< -55 dBc over 0-500 MHz (unmodulated carrier)
Phase Noise: > 6 dB below IESS-308 limits

L Band Monitor Output

Output Power
-30 dB nominal relative to Main
L-band output power
Impedance: 75Ω
Connector: F-type female

DC Power Output

Voltage: 24 V switchable on/off

Current: 500 mA maximum, short circuit protected

10 MHz Reference Output
Output Power: 0 dBm ±3 dB sine wave into 50W load, switchable on/off
Frequency Stability: ±5.5 Hz over 10 years

Carrier Combining Input
Path Gain to Main L-Band Output: 0 dB ±2 dB
Input Power: +5 dBm maximum
Intermodulation Products: < -60 dBc/4 kHz
Input Impedance: 50Ω
Connector: SMA (F)

Distortion Correction

Cable Tilt Correction
±0.04 dB/MHz maximum (Digitally generated)

Satellite AM-AM, AM-PM and Group Delay Correction
PREKOR™ (option)

Modulation Features

DVB-S and DVB-DSNG

Signal Conditioning
EN 300 421 (DVB‑S) and EN 301 210 (DVB‑DSNG)
Modulation: BPSK, QPSK, 8PSK (option) and 16QAM (option)
FEC BPSK/QPSK: 1/2, 2/3, 3/4, 5/6, 7/8
FEC 8PSK: 2/3, 5/6, 8/9
FEC 16QAM: 3/4, 7/8

Symbol Rate
1 to 48 Msymbol/s
0.2 to 66 Msymbol/s (option)
Variable in 1 symbol/s increments
Spectrum Roll-off Factor α: 20%, 25%, 30%, 35% user selectable

DVB-S2
Signal Conditioning: EN 302 307 For Broadcast Services
Modulation Mode: Constant Coding and Modulation
Modulation: QPSK, 8PSK (option), 16APSK (option), 32APSK (option)
FEC QPSK: 1/4, 1/3, 2/5, 1/2, 3/5, 2/3, 3/4, 4/5, 5/6, 8/9, 9/10
FEC 8PSK: 3/5, 2/3, 3/4, 5/6, 8/9, 9/10
FEC 16APSK: 2/3, 3/4, 4/5, 5/6, 8/9, 9/10
FEC 32APSK: 3/4, 4/5, 5/6, 8/9, 9/10
FEC Frame Size: Normal and Short
PL Scrambling Sequence: User selectable

Symbol Rate
1 to 48 Msymbols/s
0.2 to 66 Msymbols/s (option)
Variable in 1 symbol/s increments
Switchable On/Off

Pilot Insertion
Spectrum Roll-off Factor α: 20%, 25%, 30%, 35% user selectable

Control

Front Panel: 2 line x 40 character LCD display
Navigation: 4 cursor keys, 2 function keys
RS-232 / RS-485: Via RS-232/485 control port using VT100 emulator or PC control software
Connector: 9-way D-type (M)

Ethernet
Dual-redundant 10BaseT Ethernet
Web browser control interface
Telnet/FTP
SNMP
Connectors: 2 x RJ45
Reset/Status Port: Relay contacts for signaling equipment and input signal failure
Connector: 9-way D-type (F)

Physical and Power

1RU, 19" rack mounting
Approximate Weight: 8 kg
Supply Voltage: 100-120 Vac and 220-240 Vac, wide‑ranging
Power Consumption: Approx. 60W (dependent upon options fitted

Environmental Conditions

Temperature Range
0°C to +50°C (32°F to 122°F) operational
-20°C to +70°C (-4°F to 158°F) storage

Relative Humidity
0% - 90% (non-condensing)

Compliance

CE marked in accordance with EU low voltage and EMC directives. Standards applied: EN55022, EN55024, EN61000-3-2, EN61000-3-3 for EMC and EN60950 for Safety, as a minimum where applicable. Also meets other relevant requirements and national standards derived from international requirements on which the above European Standards are based and FCC Pt 15B. Designed to meet UL 1950.